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IMPLEMENTATION OF FOREST-RELATED DECISIONS OF THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT AT THE NATIONAL AND INTERNATIONAL LEVELS, INCLUDING AN EXAMINATION OF SECTORAL AND CROSS-SECTORAL LINKAGES

Programme element I.4: Fragile ecosystems affected by desertification, and the impact of airborne pollution on forests

Report of the Secretary-General

SUMMARY

General

The present document reports on progress made in the implementation of decisions of the United Nations Conference on Environment and Development related to programme element 4 of category I (Implementation of United Nations Conference on Environment and Development decisions related to forests at the national and international levels, including an examination of sectoral and cross-sectoral linkages) of the work programme of the Ad Hoc Intergovernmental Panel on Forests. It is presented in two parts. Part one deals with progress related to afforestation, reforestation and the restoration of forest systems, where appropriate, particularly in countries with fragile ecosystems and those affected by desertification and/or drought, particularly in Africa. Part two presents progress related to the impact of airborne pollution on forests, in particular those in Central and Eastern Europe.

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Part one. Fragile ecosystems affected by desertification

The United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa is expected to enter into force shortly, as it has already been ratified by over 30 countries. In resolution 5/1 on urgent measures for Africa, the Intergovernmental Negotiating Committee for the Elaboration of the Convention urged affected country parties, developed country parties and regional and international organizations to take immediate measures towards the implementation of the Convention in Africa in particular by initiating and supporting the formulation of national action programmes (see A/49/84/Add.2, annex, appendix III). Such action has started or is being prepared in many African countries and in countries in other regions. This involves a number of initiatives that are relevant to programme element I.4 of the Panel's work programme as it relates to drylands. A number of recent events have supported the request of the Panel to seek the strongest possible coordination in the implementation of the Convention and action related to chapter 11 of Agenda 21 in drylands. Many initiatives have also examined the approaches to the elaboration of national action programmes; these initiatives have addressed the need for sustainable management of natural resources, including forests, in drylands, as well as the need for participatory approaches and decentralization.

The Expert Meeting on the Rehabilitation of Degraded Forest Ecosystems, convened at Lisbon from 24 to 28 June 1996 under the sponsorship of Portugal, Cape Verde and Senegal, was the culmination of the many initiatives taken in the period under review. This meeting was placed at the highest political level by the sponsoring countries; it resulted in a number of important recommendations and proposals for action, taking into full consideration many of the ideas developed by previous processes. These recommendations merit thorough review and incorporation in present and future activities in the rehabilitation of degraded forest ecosystems in drylands.

Part two. Impact of airborne pollution on forests

Monitoring of forest health has been carried out in Europe and North America since the 1980s, following concern over the defoliation and discolouration of foliage. This has been linked to increased deposition of airborne pollutants. Radioactive material fallout associated with episodic events may also be of some consequence. Ten-year results of such monitoring in Europe have revealed an overall reduction in forest health, although there are some grounds for optimism in that the predicted widespread forest death did not occur and the levels of some emissions have recently fallen.

The importance of the critical loads approach under the Convention on Long-Range Transboundary Air Pollution in identifying forest sites likely to be at risk from airborne pollutants is stressed. The intensive monitoring of forest health through networks of permanent plots should be continued and expanded outside Europe and North America. The evaluation of data from such

plots will improve knowledge of the relationships between airborne pollution and forest condition, but financial and political conditions for this work needs to be ensured by participating countries. Research is needed not only at the national but also at the regional level into the stabilization of forest ecosystems.

Emission reduction must continue to be considered of high importance, and political efforts to reach and implement further international binding agreements under the Convention on Long-Range Transboundary Air Pollution should be intensified.

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INTRODUCTION

1. The present report describes progress made in the implementation of decisions of the United Nations Conference on Environment and Development related to programme element 4 of category I (Implementation of United Nations Conference on Environment and Development decisions related to forests at the national and international levels, including an examination of sectoral and cross-sectoral linkages), of the work programme of the Ad Hoc Intergovernmental Panel on Forests. It is presented in two parts. Part one deals with progress related to afforestation, reforestation and the restoration of forest systems, where appropriate, particularly in countries with fragile ecosystems and those affected by desertification and/or drought, particularly in Africa. Part two presents progress related to the impact of airborne pollution on forests, in particular those in Central and Eastern Europe.

2. The work under this programme element (I.4) is guided by chapter 11 of Agenda 21, the Non-legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests (Forest Principles) and the decisions taken at the third session of the Commission on Sustainable Development and further elaborated at the first and second sessions of the Ad Hoc Intergovernmental Panel on Forests.

3. The Commission on Sustainable Development, at its third session, defined programme element I.4 as follows: "Monitor actions to support afforestation, reforestation and the restoration of forest systems, where appropriate, particularly in countries with fragile ecosystems and affected by desertification and/or drought, particularly in Africa. Within this context, also consider specific actions in countries whose forests are affected by pollution, particularly those with economies in transition in Central and Eastern Europe". 1/

4. Subsequently the Panel, at its first session, emphasized the need for "a report on the experience with afforestation and the restoration of forest systems, where appropriate, particularly in countries with fragile ecosystems and those affected by desertification and/or drought, particularly in Africa, including links to the implementation of the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa. A synthesis of the impact of air-borne pollution on forests - in particular, those in Central and Eastern Europe - and an assessment of ongoing activities and proposals for possible future action would also be included. The report should include an assessment of the expansion of all types of forest cover due to reforestation and afforestation" (see E/CN.17/IPF/1995/3, para. 18). Also at its first session, the Panel decided to schedule programme element I.4 for substantive discussion at its second session (Geneva, 11-22 March 1996), and to request the Secretary-General to prepare a progress report for its third session.

5. The outcome of the substantive discussion related to programme element I.4 at the second session of the Panel is contained in the Panel's report (E/CN.17/1996/24). The present report follows the guidance given by the Panel at that session. It also takes into consideration paragraph 13 of the Statement

on Biological Diversity and Forests from the Convention on Biological Diversity to the Intergovernmental Panel on Forests (UNEP/CBD/COP/2/19).

6. The present report was prepared by the Food and Agriculture Organization of the United Nations (FAO), as lead agency for programme element I.4, in consultation with the secretariat of the Ad Hoc Intergovernmental Panel on Forests in the Division for Sustainable Development of the Department for Policy Coordination and Sustainable Development of the United Nations Secretariat. Inputs and comments on part one were received from the International Cooperative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) (coordinated by Germany), the United Nations Environment Programme and the Forestry Commission of the United Kingdom of Great Britain and Northern Ireland.

7. Part one of the report benefited greatly from the Expert Meeting on the Rehabilitation of Degraded Forest Ecosystems (Lisbon, 24-28 June 1996), sponsored by Portugal, Cape Verde and Senegal. The meeting was attended by 124 experts from 58 countries in Europe, North and South America, Asia, the Near East and North Africa, and Africa south of the Sahara, the European Union and international organizations.

PART ONE. FRAGILE ECOSYSTEMS AFFECTED BY DESERTIFICATION

INTRODUCTION

8. Drylands around the world are inhabited by nearly 850 million people, mostly in rural communities. The health and vigour of forests, wooded lands and trees in these areas strongly affect the lives of the people, who often depend upon them to meet subsistence needs.

9. The Forest Principles, chapters 11 and 12 of Agenda 21 and the Convention to Combat Desertification together provide a substantive framework which could support, guide and monitor national and international efforts to assess, manage and conserve fragile dryland ecosystems, including forests, wooded lands and trees, natural or planted, of dry areas.

10. The ratification and implementation of the Convention to Combat Desertification with its principles of popular participation; decentralization; mix of local, national and international contributions as regards investments and management; and partnership arrangements will greatly contribute to the integrated development and conservation of dryland forest ecosystems.

I. OUTCOME OF THE DISCUSSIONS AT THE PANEL'S SECOND SESSION

11. The substantive discussion of programme element I.4 at the Panel's second session benefited to a large degree from the broader dialogue under the Convention to Combat Desertification.

12. The report of the Panel on its second session included the following observations:

(a) Desertification and drought affect all regions of the world and can create problems of global dimensions;

(b) In the consideration of programme element I.4, ongoing efforts under existing international conventions, in particular the Convention to Combat Desertification, should be taken into account;

(c) In the management, conservation and sustainable development of forests, wooded lands and trees in drylands, important local social, economic and environmental dimensions should be taken into account;

(d) The capabilities of local communities to be adequately involved in the decision-making processes for, and in the implementation of, the management, conservation and sustainable development of their resources need to be supported and strengthened. These should include training in the inventory and use of local knowledge; development of supporting legislation and establishment of tenure; and establishment of partnerships to support local development;

(e) Afforestation activities should be closely linked to the management and conservation of remaining natural forests and tree formations.

13. Although the Panel considered afforestation and forest restoration activities as only part of the solution for sustainable management of dry forest ecosystems, they remain important options when degradation is extreme but not beyond recovery, and when allocating more land to forest cover and productive forests is of strategic importance.

II. CURRENT STATUS OF ISSUES RAISED AT THE PANEL'S SECOND SESSION

14. The multitude of different frameworks promoted both bilaterally and multilaterally have created confusion and incoherent activities in recipient countries in the past. The Convention to Combat Desertification could provide a mechanism for facilitating the harmonization of planning frameworks, especially for extensive dry zones, that are more consistent with needs at the country level. The Convention also emphasizes natural resources conservation and the management and sustainable development of forest resources, consistent with chapter 11 of Agenda 21.

15. The role and usefulness of plantations were discussed at the Panel's second session, both in general and for dry zones. There seems to be a growing acceptance of the potential complementarity and conceptual continuum of operations involving forest conservation and management, afforestation, reforestation and sustainable use.

16. There are examples at the national level confirming the strategic value of afforestation and reforestation in restoring productivity and conserving the forest reserve base. However, increasing attention needs to be paid to a balanced mix of ecological, social and economic dimensions in the design and implementation of these kinds of operations. In areas where plantations are designed to achieve multiple purposes, especially for fulfilling subsistence

needs of local populations, methodologies have to become more efficient and designed to reinforce the process of expanding forest cover.

17. Several initiatives at the regional level have taken place or are planned for the near future in connection with improving the readiness to implement the Convention to Combat Desertification. These initiatives are also relevant to programme element I.4 of the Panel's programme of work and include:

(a) Praia (Cape Verde) meeting (12-15 May 1996). This meeting was supported by FAO and attended by 15 countries. It centred on the interface between planning frameworks and local area development. Issues such as decentralization, participation and the formulation of national action programmes were also discussed;

(b) Second Latin American Conference on the International Convention to Combat Desertification (Mexico, 17-19 June 1996). Information on the results of the Conference is not yet available;

(c) Nairobi Meeting to Support the Implementation of the International Convention on Desertification in Africa (20-21 June 1996). Information on the results of the Meeting is not yet available;

(d) Tunisia Workshop on Measures and Mechanisms for the Implementation of the Convention to Combat Desertification at the African Level (Cairouan, 25-27 March 1996). This workshop discussed arrangements and strategies for the coordination and harmonization of subregional action programmes to combat desertification in Africa;

(e) United Nations System-wide Special Initiative on Africa. This initiative, which was launched on 15 March 1996, will address a number of issues of critical importance to Africa, such as better use of natural resources, including dry forest formations, especially their role in contributing to food security;

(f) Study on afforestation experience in the Nordic countries. This study provides a historical perspective on plantations for land rehabilitation and rural development, and illustrates the importance of political commitment combined with a popular movement and action by landowners and grass-roots organizations. The recent experience of Iceland demonstrates that when this combination exists, it is possible to carry out successful reforestation programmes even under very adverse natural conditions.

18. International cooperation can contribute substantively to increasing the exchange of experiences on cost-effective approaches to conservation and sustainable development of dryland forest ecosystems, as well as on tree species that can provide multiple benefits in wide geographical areas.

19. A number of activities at the international level have been initiated or are planned in order to increase the effective exchange of experiences or ideas in this area; they include:

(a) The Neem Network. This is an international technical cooperation network focusing on the role of multipurpose tree species in dryland development. It comprises around 20 countries. It held a meeting in Washington D.C., United States of America, in mid-March 1996, to review activities related to the multiple use of the Prosopis species and to encourage further cooperative action;

(b) Meeting of the Asia and Pacific Region on the Parkia species, to be held in Thailand. The Meeting could suggest the creation of a Parkia Network to examine further improvement and better sharing of knowledge of this species, which is of critical importance for food production in dry, sub-humid and humid tropical areas;

(c) Eleventh World Forestry Congress. The Congress is to be held in Antalya, Turkey in October 1997. Afforestation and reforestation, as well as management of dryland forests will receive special attention. The idea of organizing a satellite meeting on the role of forestry in combating desertification (Saltillo II) is being proposed by FAO in preparation for the Congress;

(d) Studies on the management of dry forest formations. The Centre for International Forestry Research (CIFOR) has made extensive studies of the Miombo woodlands and is also assessing the situation in Latin America. FAO has just completed the first draft of a report on the current state of knowledge in dryland forest management;

(e) The International Convention to Combat Desertification/International Fund for Agricultural Development (ICCD/IFAD) Forum on Local Area Development (Rome, 5-7 June 1996). This Forum discussed in depth the content and articulation between national action programmes and regional and local area development plans, as well as their design and implementation;

(f) Expert Meeting on the Rehabilitation of Degraded Forest Ecosystems (Lisbon, 24-28 June 1996), sponsored by Portugal, Cape Verde and Senegal. This Meeting, which was held in cooperation with FAO and with financial support from the European Union, had a high technical and political profile. It was attended by 124 experts from 58 countries. The results of the Meeting were entrusted to the President of Portugal who chaired the closing ceremony and delivered a supportive address.

III. ASSESSMENT OF RECENT DEVELOPMENTS

20. Forests, wooded lands and trees will play an important, if not crucial, role in mitigating the effects of desertification and drought. Combined and better integrated efforts to implement chapter 11 of Agenda 21 and the Convention to Combat Desertification could greatly enhance the efficiency of any activities involving the restoration of degraded lands through afforestation and reforestation.

21. There is increasing awareness of the critical subsistence, environmental and socio-economic functions of dryland forest ecosystems. These dimensions

will demand new kinds of partnership arrangements involving local populations and other interested parties. An e-mail Conference on Conflict Management in Natural Resource Use (February-April 1996), sponsored by the FAO Forests, Trees and People (FTP) programme, and well "attended" by countries from dry regions, showed the enormous challenges to sustainable management of natural resources in the face of competing demands.

22. Addressing the challenges of conserving, managing and sustainably using forest ecosystems of dry areas and of increasing their forest cover will require continued political will at all levels. There is some reason for optimism in this regard, as demonstrated by the many regional and international initiatives held in support of the Convention to Combat Desertification and programme element I.4 of the Panel's work programme. It is to be hoped that these initiatives will be reflected by political will and action at the national level.

IV. FUTURE CHALLENGES

23. Provided the heightened international political attention to the plight of the fragile ecosystems of drylands translates into political commitment and action at the national level, concrete, local action has the potential to become effective and transformative. The use of trees can be key to this transformation. Forests can not only contribute to solving the problem of desertification and the effects of drought, but also meet subsistence needs of local populations and, in the long run, even provide income and employment.

24. There are, however, numerous challenges to overcome to reach this goal. These challenges can be more easily addressed if support is mobilized for the formulation of comprehensive national, provincial and local action programmes to combat desertification and the effects of drought, which pay due consideration to the role of woody vegetation and plant-based restorative measures.

25. The cross-sectoral nature of the problems faced by these areas have meant that traditional ways for programme and project identification, formulation and implementation at the national, regional and international levels have become cumbersome and time-consuming. The challenge of addressing acute problems with effective actions quickly exists at all levels.

26. The use of plantations, afforestation and reforestation as restorative measures is especially relevant for fragile ecosystems affected by desertification and drought. However, these measures are being implemented too slowly to keep up with the rate of the processes leading to degradation. A major challenge in this context is the development of effective policy guidance and effective methods and technologies for implementation.

27. Scientific knowledge of the dynamics of dry forest management, afforestation, reforestation and the role and usefulness of plantation will be increasingly needed not only for effective implementation at the field level but also for policy formulation at all levels. Effective channels for feeding this knowledge to potential users need to be explored. One option that should be

examined is the Committee on Science and Technology of the Conference of the Parties to the Convention to Combat Desertification.

V. PROPOSALS FOR ACTION

28. This section consolidates the main conclusions and recommendations emanating from the discussion on programme element I.4 at the second session of the Panel, as well as those of part one of the present report. It also takes into account the issues identified as of high priority at the Expert Meeting on the Rehabilitation of Degraded Forest Ecosystems (Lisbon, 24-28 June 1996).

National dryland programmes and policies

29. The Panel may wish to consider the formulation, by the year 2001, of explicit national forest policies which address dryland concerns, including forest resource conservation, management and sustainable development, that encompass the paradigms of local peoples' involvement, sound management of ecosystems and socio-economic dimensions.

Capacity-building

30. The Panel may wish to consider:

(a) Strengthening of institutional capacity in order to:

(i) Involve civil society and non-governmental organizations in the planning, design and implementation processes;

(ii) Empower local communities;

(iii) Facilitate the establishment of partnerships in the management and conservation of natural resources;

(iv) Facilitate access to financial resources at the national and local levels;

(b) Strengthening national capacity-building efforts in order to:

(i) Educate local populations in sustainable management of fragile ecosystems, especially the poor and women, as well as youth, to whom these resources will be entrusted in the future;

(ii) Develop and improve technical and university curricula to include themes on desertification and management of natural resources in drylands.

Land tenure

31. The Panel may wish to consider the urgent initiation of land tenure reforms to promote higher security of investments and interventions.

Periodic assessment

32. The Panel may wish to consider setting up mechanisms and strengthening national capacities for periodic assessments of the state of natural resources in support of:

(a) Assessment of the state of trees, woodlands and forest and the processes affecting them;

(b) The design and implementation of prevention, rehabilitation and development strategies;

(c) Setting specific targets and time-frames for reaching objectives.

Preventive and restorative measures

33. The Panel may wish to consider:

(a) Timely and preventive measures to manage non-degraded natural and man-made forest stands, as well as all types of plant cover on a sustainable basis;

(b) Restoration measures using:

(i) The potential of both native and/or exotic species;

(ii) Appropriate techniques accepted by local populations;

(iii) Impact assessment of all potential activities;

(c) The formulation of guidelines for sound conservation and environmental management of large-scale plantations in order to:

(i) Optimize positive and minimize negative effects of afforestation and reforestation activities;

(ii) Evolve rules or a code of conduct for the establishment of plantations;

(iii) Provide a gauge against which impacts of plantations can be studied.

Coordination

34. The Panel may wish to:

(a) Pursue efforts under way to coordinate planning frameworks concerning fragile ecosystems affected by drought and desertification, in the light of the integrated nature of the Convention to Combat Desertification;

(b) Encourage regional and subregional efforts where they already exist - for example the Permanent Inter-State Committee on Drought Control in the Sahel (CILSS), the Intergovernmental Authority on Drought and Development (IGADD) and

the Southern African Development Community (SADC) - and their development where they do not, in order to ensure coordination and action-oriented follow-up.

PART TWO. IMPACT OF AIRBORNE POLLUTION ON FORESTS

INTRODUCTION

35. During the 1970s, defoliation and discolouration of trees was reported from certain forest sites in Central Europe. In the early 1980s the same symptoms, though generally less pronounced, were identified in many other parts of Europe. The damage observed coincided with increasing deposition of such airborne pollutants as sulphur dioxide and the oxides of nitrogen as well as ozone, even in rural areas. Long-range transport of airborne pollutants from highly industrialized areas to remote rural areas had already been recognized following the acidification of lakes and rivers in parts of Scandinavia.

36. Concern over forest health was also expressed in North America in the 1970s, although in the United States of America and Canada the regional diversity in the combinations of causal factors was acknowledged from the outset.

37. The independent group of experts under an initiative of Peru and Switzerland have noted the significance of radioactive airborne pollutants, associated with episodic events for the health of forest ecosystems.

38. The need for multilateral efforts at the political and scientific levels to protect the forests of Europe led, in 1985, to the establishment of the International Cooperative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) established under the auspices of the Convention on Long-Range Transboundary Air Pollution within the framework of the United Nations Economic Commission for Europe (ECE). It cooperates closely with the European Commission. At present 34 European countries, the United States and Canada participate in this Programme.

39. After 10 years of assessment and monitoring of forest condition, knowledge of the spatial and temporal distribution of forest damage has grown considerably, and public awareness of air pollution as a threat to the environment and notably to forests has increased, providing an impetus for new national and international environmental policies and expanded research into forest damage.

I. OUTCOME OF THE DISCUSSIONS AT THE PANEL'S SECOND SESSION

40. The Panel, after reviewing the report of the Secretary-General (E/CN.17/IPF/1996/3) on programme element I.4, as it relates to the impact of airborne pollution on forests, noted that the problem was not restricted to Europe but occurred in many other parts of the world. While continued monitoring of the impact of air pollution on forest health was needed and should continue in the European Union and ECE and should be extended to other areas as required, the Panel nevertheless stressed the need for a preventive approach to

combating air pollution. It was noted that solutions to the problem lay outside the forest, and the need for transfer of technology as well as consideration of production and consumption patterns was stressed.

41. The Panel noted that national strategies might include prevention of damaging air pollution and reduction of transboundary pollution. The Panel emphasized that countries should be encouraged to cooperate in activities related to the impact of airborne pollution on forest health and in disseminating and providing access to information and data to the general public, managers and policy makers. Furthermore, research and field data collection should be continued, with particular reference to the study of forest ecosystems, whose sustainability was threatened by pollutant depositions.

42. The Panel considered that an evaluation should be made of forest decline and pollutant-related declines worldwide, and of actions taken to address them, as well as a synthesis of the impact of airborne pollutants on forests in Central and Eastern Europe in particular, and an examination of ongoing activities and proposals for future actions.

43. The Panel noted that forest planning and management should recognize the potential impact on forest health from nutrients and pollutants from the atmosphere, acting in combination with other processes such as natural weathering and leaching.

44. The Panel stressed the importance of the Convention on Long-Range Transboundary Air Pollution. The widespread and general adoption of the critical loads approach in the context of the Convention was welcomed. This approach may be considered by those countries whose forests are, or may be, affected by air pollution and which are not at present parties to the Convention.

II. CURRENT STATUS OF ISSUES RAISED AT THE PANEL'S SECOND SESSION

45. ICP Forests was mandated to monitor air pollution effects on forests and to contribute to a better understanding of cause-effect relationships. In pursuing these objectives it has gained knowledge of the spatial and temporal variations in forest condition and of its relationship to stress factors at the national, regional and international levels. The actions taken so far were coordinated closely with the European Union programme for the protection of forests against atmospheric pollution (EC Regulation No. 3528/86)

46. Two monitoring levels have so far been established to reach the above-mentioned objectives:

(a) Extensive periodic assessments on a large-scale grid (16x16 km), covering 34 European countries, of the condition of approximately 102,000 trees, by annually assessing defoliation and discolouration of needles/leaves. In addition, on all the 4,800 sample points, a forest soil condition survey is being executed, to gain basic information on the chemical soil status and on soil properties which determine its sensitivity to air pollution. On one third

of these sample points foliar analyses are conducted. The results of the assessments, to be published in 1997, will give area-related mean values;

(b) Intensive and continuous monitoring activities are carried out on approximately 170 permanent observation plots in 28 European countries, which include crown condition assessments, soil and foliar analyses, increment studies, soil solution analyses, deposition and meteorological measurements and ground vegetation assessments. The results of these activities will be presented as site-specific case studies. Comparisons of results between plots will have to be done with great care due to the great variability of site conditions .

47. In addition to these two monitoring levels ICP Forests is also investigating special topics, such as the effects of heavy metal deposition on forest ecosystems.

III. ASSESSMENT OF RECENT DEVELOPMENTS AND REASONS FOR OPTIMISM

48. Ten years of large-scale crown condition assessments have revealed an overall deterioration of forest health in Europe. For the period 1988-1995, there has been a relative increase in the number of damaged trees among the 12 more important forest tree species. Today roughly one in four sample trees is classified as damaged - that is, it is not dead but its vitality is weakened and it has lost at least 25 per cent of its needles/leaves compared with healthy trees in the same region. Although this deterioration seems moderate on a European scale, the damage is severe in certain regions such as Central and Eastern Europe. In these areas 100,000 to 200,000 hectares of forests have died within the past 20 years - that is, about 0.1 per cent of the forests in Europe as a whole (Russia excluded). Efforts to replant these areas are ongoing.

49. The areas of the highest forest damage in Central and Eastern Europe correspond fairly well with the areas of the highest sulphur emission concentrations in Europe. The atmospheric concentrations and the depositions of several air pollutants in those areas are thought to exceed the critical levels and loads for forest ecosystems. Pollutant emissions and depositions have been changing historically, both qualitatively and quantitatively. European sulphur emissions have risen from less than 5 million tonnes of sulphur dioxide in 1880 to a peak of nearly 60 million tonnes in 1975, with the geographical pattern of emissions, and thus of depositions, also changing substantially. Emissions had declined to about 48 million tonnes a year by 1990 and were continuing to fall.

50. Trends are not so clear for nitrogen compounds, but emissions have also increased substantially with industrialization and the increase in motor vehicle emissions. Recent surveys have shown roughly stable emissions of nitrogen oxides from European countries between 1980 and 1993, and a moderate decrease in ammonia emissions between 1980 and 1993.

51. Ozone shows considerable regional variation, being dependent on both climatic conditions and the emission of precursors, but on a regional basis they must be considered as potentially damaging to trees. All these pollutants, and others, notably heavy metals, have the potential to influence plant growth

directly through their effect on climate (the "greenhouse gases") or via soil-mediated effects such as contamination, acidification, accelerated weathering or the leaching of nutrients.

52. Forest damage can be explained as a complex interaction of many natural influencing factors, such as insects, fungi, or extreme weather conditions. Biotic agents with temporal and regional variations lead to fluctuations in the health status of trees but the important role of air pollution in this context is supported by results of more symptom-specific studies of injury arising from air pollution. More than half the European countries involved in the ICP Forests work consider air pollution as a predisposing, accompanying and locally triggering factor for forest damage.

53. There are, however, reasons for optimism. The widespread and catastrophic "forest death" which was feared in Europe has not occurred. The effects of pollutant depositions are subtle and, at least in the short term, may have little impact, unlike extremes such as windthrow, severe drought or outbreaks of pests. Furthermore, the shift from often inefficient State-controlled industries and the growth in the economies of Eastern Europe in recent years has both reduced the sources of pollution and increased the likelihood of a further reduction in emissions.

54. Another optimistic development is the acceptance of concepts of forest health and vitality as one criterion of the four main international sets of criteria and indicators for sustainable forest management (Helsinki and Montreal Processes, Tarapoto Proposals and Proposals for Dry-zone Africa). Two of these sets have included indicators of airborne pollution as quantitative measures of the criteria (Helsinki and Montreal Processes).

IV. ASSESSMENT OF THE OBSTACLES TO BE OVERCOME AND CHALLENGES FORESEEN

55. Since air pollution is the predisposing, accompanying and locally triggering factor for forest damage then the reduction of airborne pollutants is one of the main keys to protecting forests.

56. At the international level, it is important to implement the existing internationally binding instruments, notably those under the Convention on Long-Range Transboundary Air Pollution. Since its entry into force in 1983, the Convention has been extended by specific protocols such as the Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes (1985, revised in 1994) and the Protocols concerning the Control of Emissions of Nitrogen Oxides (1988) and of Volatile Organic Compounds (1991).

57. The development of effect-based abatement strategies, taking into account the critical level and load concept as an essential tool at the regional level, has been a substantial step forward. In the coming years, the highest priority will be given to the development of the second Protocol on the Control of Emissions of Nitrogen Oxides. While sulphur emissions have been reduced in nearly all European countries, nitrogen emissions have increased significantly

in many. Controlling the sources of nitrogen has therefore become even more important.

58. As in Europe, so in other parts of the world: a good knowledge of the location of sensitive areas and of the threshold deposition values above which damage occurs (the critical load) would allow measures to be taken before problems attain serious proportions. Evidence from South and East Asia indicates the need for early action, since critical loads are probably already being exceeded in parts of China, India and Japan. The sensitivity maps which are being produced for developing countries need to be evaluated by local scientists, while verification is needed through international assessment and monitoring schemes.

59. Many European countries have committed themselves to these international efforts to reduce their emissions by even higher percentages than internationally agreed. The States members of the European Union, for example, will reduce their sulphur dioxide emissions by the year 2000 by 65 per cent compared with 1980. This effect-oriented approach will continue to require information on the recent status and trends in forest condition, so that the monitoring activities of ICP Forests and the European Union will remain highly important.

60. In addition to these clean-air measures most European countries are promoting forestry measures (for example, soil liming and reafforestation with tree species adapted to the site) designed to increase the resistance of their forests to harmful influences. Interdisciplinary forestry research will continue to be supported as an indispensable condition for further clarifying cause-effect relationships of forest damage.

V. PROPOSALS FOR ACTION

61. The Panel may wish to consider the proposals for action set out below:

Emission reduction

62. The clean air measures that have already been carried out at the national and international levels are expected to lead to a further decrease in pollutant emissions and to an improvement of forest health. On the whole, however, deposition measurements show that at present there are still too many examples of pollutants being deposited into forest ecosystems exceeding the critical levels and loads. Emission reduction must continue to be of high priority in the future.

63. In order to reduce emissions, political efforts to reach further international binding protocols, for example, under the Convention on Long-Range Transboundary Air Pollution, should be maintained. The importance of the critical loads approach in the context of that Convention is stressed, as is its relevance to all countries where forests are or may be affected by airborne pollution.

64. The measures taken to reduce emissions of carbon dioxide and other climate-relevant gases under the United Nations Framework Convention on Climate Change should continue, as they will contribute to reducing the air pollutants adversely affecting forests.

Periodic assessment of the impact of airborne pollutants

65. The seriousness of the threat from air pollution and responsibility for the environment require the continuation of monitoring within the programmes of ICP Forests and the European Union in order to be informed of the status and trends in forest condition. Annual assessments on a large-scale grid are of high priority. Special efforts will have to be made in the coming years to intensify ongoing activities for the intensive monitoring of selected forest plots. Careful evaluation and interpretation of the data collected so far will be needed in order to improve the knowledge of cause/effect relationships between air pollution and other important factors influencing forest condition and the health of forest ecosystems. Where appropriate and necessary, such monitoring may be extended outside the European Union and North America.

66. The financial and political conditions for this important work must be ensured by the participating countries. Suitable arrangements should be made for the transfer of relevant technologies for forest health monitoring and for liaison and cooperation.

67. Information on status and trends in forest condition has been identified as one of the criteria of sustainable forest management (see E/CN.17/IPF/1996/21). The programmes of ICP Forests and the European Union may be used to assess the quantitative indicators related to this criterion and a similar approach may be adopted in other areas.

68. The Panel may wish to recommend the approach taken by ICP Forests for application in other regions of the world where air pollution has been identified as a factor affecting forest health.

Research

69. Forest ecosystem research and the promotion of accompanying forestry measures to stabilize forest ecosystems should continue at the national level as well as at the regional and global levels.

Rehabilitation of affected areas

70. Continued emphasis is necessary in the rehabilitation of certain forest areas in Central and Eastern Europe, where the main damage areas are concentrated. In certain cases specific interventions, such as soil liming, to buffer acid depositions, could be a useful tool to reduce the negative impacts of air pollution.

Notes

1/ Official Records of the Economic and Social Council, 1995, Supplement No. 12 (E/1995/32), chap. I, sect. D, annex I, sect. III.